

MEMORANDUM FOR: Clifton S. Middleton  
Project Director, Survey Section B

FROM: Charles W. Challstrom  
Director, National Geodetic Survey

SUBJECT: INSTRUCTIONS: VERMONT AND NEW HAMPSHIRE FBN,  
2000 (GPS-1506)  
Task Numbers: 8K6D2000 (FBN)  
8K6D4000 (CORS FBN/CBN TIE)

GENERAL:

The National Geodetic Survey (NGS), in accordance with the NGS Strategic Plan, is engaging in a campaign of observing stations of the Federal Base Network (FBN) to complete the ellipsoidal and orthometric height components of the FBN. This survey will observe the 5 FBN stations in Vermont and the 5 FBN stations in New Hampshire.

Reconnaissance has been performed for both states, and all the FBN stations are suitable for GPS occupation.

At two locales in New Hampshire, station CONSTITUTION 147 RM 1 (PID OC0429) was chosen as a FBN over station PORTSMOUTH USCG, and station ZBW B (PID AA3501) was chosen as a FBN over station ZBW A.

No additional bench marks to serve as ties in either state were required.

In addition, at the Vermont Capital Continuously Operating Reference Station (CORS), a pair of CORS reference marks is to be tied to both the local FBN/CBN and the CORS antenna. Details are given under SPECIFICATIONS.

Lastly, in Vermont, stations 740 (PID PG0418), C 22 (PID PG0208), TT 40=1785 (PID MZ0318), and WEYBRIDGE (PID PG2641) have been added to the project in order to check ellipsoid heights versus leveling. Likewise, in New Hampshire, stations 219 0090

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(PID MZ2996) and H 35 (PID OC0921) have also been added for the same reason. The six stations are to be observed to FBN specifications.

A full-wavelength, dual-frequency Global Positioning System (GPS) receiver is needed to act as Central Temporary CORS (CTCORS) throughout the project. The receiver shall be deployed at relatively secure stations within the vicinity of the ongoing observing sessions. The receiver shall continuously collect data at a 30-second epoch collection interval for a minimum of 72 hours and for as long as observations are ongoing in the vicinity of the CTCORS.

In Vermont, a total of approximately 24 Cooperative Base Network (CBN) stations will be co-observed by the Vermont Agency of Transportation (VAT). Observations of the stations will be divided between the VAT's Geodetic Survey Section and Route Survey Section. The CBN coordinator in Vermont is Mr. Dan Martin, VAT.

In New Hampshire, a total of approximately 19 CBN stations will be co-observed by up to 15 different organizations. The CBN coordinator in New Hampshire is Mr. Curt Crow, NGS Geodetic Advisor.

In addition, 5 stations in the province of Quebec, Canada, will be co-observed by the Service de la geodesie, Ministere des Ressources naturelles. The coordinator for this is Mr. Bernard Perron.

The project will be performed under the technical management of NGS.

#### PURPOSE:

In order to meet America's accelerating positioning and navigation needs, the existing coordinate reference system must be continually enhanced to provide the accessibility and high accuracy required for use with GPS. The digital revolution in mapping, charting, and surveying requires a National Spatial Reference System (NSRS) consisting of, among other components, a network of monumented points having four-dimensional positions. The FBN fulfills the requirements for this component. NGS is charged with the Federal responsibility for establishment, observation, monitoring, and maintenance of the FBN. The FBN provides the critical network

foundation for an accurate, consistent, reliable NSRS.

The NSRS, in turn, provides the common geographic framework for America's spatial data infrastructure. As such, the NSRS serves as the basis for mapping, charting, navigation, boundary determination, property delineation, infrastructure development, resource evaluation surveys, and scientific applications, including crustal motion monitoring, modeling of flooding, storm surge, pollution trajectories, and agricultural runoff. A modernized, accurate, consistent, reliable NSRS is of enormous benefit to state, county, tribal, local, and Federal authorities, as well as to the private sector.

The reference marks established at the Vermont Capital CORS site will provide a very accurate tie to the antenna as an aid to reposition the antenna should that become necessary. The FBN/CBN tie to the reference marks will also provide site station coordinates relative to the local FBN/CBN, thus reducing the potential for relative error between the reference marks and the local network. It will also provide a check on the FBN/CBN, relative to the CORS coordinates.

#### SPECIFICATIONS:

Project requirements for the FBN observations are to ensure 2-centimeter local accuracy in the horizontal component, as well as 2-centimeter local accuracy for the ellipsoid heights.

Data from the CORS in the region are to be used in the processing. There are five National CORS in the area to be selected from. One each is in New Hampshire, Maine, Massachusetts, New York, and Vermont. There is also a CORS in Ottawa, Canada, that is part of the Canadian Active Control System (CACS).

Also, there is a community base station in Concord, New Hampshire, and a base station (Atrium) in the province of Quebec, Canada, which should be used as well. These two base stations should be used as CTCORS as well, if possible, and Cliff Middleton, Survey Section B of NGS, will inquire as to their suitability as such.

The five National CORS are Portsmouth (POR4) in New Hampshire; Brunswick (BRU1) in Maine; Westford (WES2) in Massachusetts; Syracuse (SYCN) in New York; and Vermont Capital (VCAP) in

Vermont. Note that Westford is an International GPS Service (IGS) station and should definitely be used in the processing.

Positions for and data from the National CORS are available from the NGS web site. Data from the CACS CORS in Ottawa, Canada, is also available via the NGS web site. For data from the Concord, New Hampshire, community base station, contact Mr. Kerrie Hartshorn, New Hampshire Department of Transportation (listed under LIAISON). To obtain data from the Quebec base station (Atrium), contact Mr. Yves Theriault, Ministere des Ressources naturelles (listed under LIAISON).

General specifications for the project are as follows. At each FBN and CBN site, three sessions of 5 1/2 hours duration for each session shall be observed. The observing scheme shall be arranged so that for each station, the start time of one of the observing sessions shall be at least 4 hours different from the other two. The observing scheme shall be arranged to ensure that adjacent FBN and adjacent CBN stations are directly connected in at least one observing session, and at least half of all base lines are repeated.

Specific to the Vermont Capital CORS site is that for the two reference marks at the site, two sessions of 2 hours each shall be observed. In order to provide a check, the equipment shall be broken down and reset with a minimum of 30 minutes between the two sessions. Since the CORS site is to be tied to the nearest FBN/CBN station, the FBN/CBN station must be occupied simultaneously with the two reference marks. If the occupation of the FBN/CBN station is ancillary to the project, observe the two 2-hour sessions there and break down the equipment as described above. If the occupation of the FBN/CBN tie station is part of the general FBN/CBN sessions, occupy the station for the entire 5 1/2-hour session with no equipment breakdown.

Specifics for the Vermont Capital CORS site are as follows:

The reference marks are A93010 RESET (PID AE4167) and MAY (PID PG2656). The FBN/CBN tie station to use is RUNWAY (PID PG0338), a scheduled FBN. The backup tie station is GM 21 (PID PG1506), a scheduled CBN.

In general, station occupation and observing procedures must be carried out according to appropriate sections of the "NGS Operations Handbook" and the current applicable receiver field

manuals. Data formats and digital file definitions are given in "Input Formats and Specifications of the National Geodetic Survey Data Base," Volume I. Horizontal Control Data, Federal Geodetic Control Subcommittee, September 1994, revised and reprinted November 1998. Success in meeting the accuracy standards will be based on repeatability of measurements and adjustment residuals.

General specifications for the project are given in "Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques," Version 5.0: dated May 11, 1988, reprinted with corrections August 1, 1989. Specific project criteria and deviations from the general specifications are given in the following sections.

Project Network - A list (Table 1) and sketch of stations involved in this project will be provided.

Data Acquisition - Data collection must be accomplished as specified in the appropriate dual-frequency receiver field manuals in the compressed mode at a 15-second epoch collection interval. The GPS receivers must be dual-frequency and full-wavelength. Track satellites down to a 10-degree elevation angle.

The satellite observing scenario will be provided in Table 2. Sessions will generally begin at two observing windows at least 4 hours apart - 1300 UTC and 1730 UTC. The observing windows will shift in weekly increments of 30 minutes instead of daily increments of 4 minutes. Vectors between the project stations shall be measured by single sessions consisting of continuously and simultaneously tracking for 5 1/2 hours.

Each FBN station must be occupied at least three times - twice at one observing window and once at the other. Each FBN station must be tied to two different bench marks. This bench mark tie requirement can be satisfied in one or two sessions. Adjacent FBN stations must be directly connected in at least one observing session, and at least one-half of all FBN base lines must be repeated. The CORS base lines will be repeated. CORS and CTCORS data will be used throughout the project.

For this project, each CBN station must also be occupied three times as described above. However, CBN stations can be tied to adjacent FBN stations if the FBN station is closer than an adjacent CBN station. The repeated-base line requirement also

applies to the CBN, although a base line consisting of a CBN station and a FBN station (instead of two CBN stations) can also be used. The two bench mark tie requirement also applies to the CBN.

Record weather data just before, immediately after, and at the mid-point of each session. Meteorological data shall also be collected immediately after an obvious weather front passes during a session and immediately before it passes, if possible. Pressure and relative humidity measurements must be made near and at about the height of the GPS antenna phase center. Indicate in the log the location of the barometer and psychrometer.

Survey operations shall be conducted with due regard to the safety of personnel and equipment. Contact with the airport traffic control tower is mandatory during surveys at any controlled airports.

Vector Computations - Data management, quality review of collected data, and final vector processing for the FBN/CBN survey will be accomplished using PAGES. Vectors shall be computed in the International Earth Rotation Service Terrestrial Reference Frame (ITRF) system, using the most current epoch and precise IGS ephemerides. Use 30-second epoch intervals for data processing. Monument positions will be used for CORS when available, otherwise, antenna reference point (ARP) positions will be used. (Mr. Gary Means, N/NGS412, will be responsible for the processing of Vermont and New Hampshire.)

The data will be processed in 24-hour sessions (or slightly longer if the observation session crosses 0000 UTC) in order to utilize the 24-hour data sets collected at the CORS and CTCORS. The "fixed baseline" option in PAGES will be used to compute direct baselines between the CORS and CTCORS. The "fixed baseline" scheme will depend on the location and reliability of the CORS and CTCORS used in this project.

For stations where weather data are not available, or are suspect, predicted values computed based on the station's latitude, height above mean sea level, and time and day of year will be used. Use 15 degrees as the cutoff elevation angle in data processing. A cutoff angle of 10 degrees may be used when necessary to improve results.

The type of final solution, L1 versus ion-free, will depend on the length of the vectors. For vectors which are less than 10 km in length, the final reduction will consist of a L1 fixed solution. These vectors will be computed in a separate processing session from the longer vectors computed in an ion-free solution.

In general, vectors greater than 10 km in length are to be computed in an ion-free fixed, or partially-fixed, solution. In all cases, integer ambiguities will be fixed for each vector whenever possible.

For the Vermont Capital CORS reference marks, the CORS antenna at the site will be used as the reference station in the data processing.

The quality of collected data shall be determined from the plots generated from PAGES, by analysis of repeated vectors and/or comparison of station positions, and free adjustment residuals and/or loop misclosures. In addition, a constrained adjustment constraining all CORS will be performed.

Survey Section B will perform all quality checks for conformance with NGS format standards such as executing software programs COMPGB, OBSCHK, and OBSDES. The final ITRF vectors will be assessed and transformed to the NAD 83 coordinate system using program ADJUST.

The data and results will be submitted to the Observation and Analysis Division. All B-files and G-files must be complete, including \*25\* and \*27\* records.

Station Descriptions - Station recovery notes must be submitted in computer-readable form using DDPROC software. Include the name, address, and, if public ownership, the telephone number of the responsible party. Do not include the telephone numbers of private property owners.

Special Requirements - Antenna set-up is critical to the success of this project. Fixed-height tripods are preferred for all receivers. The plumbing bubbles on the antenna pole of the fixed-height tripod must be shaded when plumbing is performed. They must be shaded for 3 minutes before checking and/or re-plumbing. Also, the perpendicularity of the poles must be checked at the beginning of the project and any other time there is suspicion of a problem.

When a fixed-height tripod is not used, the height of the antenna must be carefully measured to prevent station set-up blunders from occurring. Tribrachs used for these set-ups must be checked and adjusted when necessary. Totally independent measurements of the antenna height above the mark in both metric and English units must be made before and after each session. Someone other than the observer must check the measurement computations by carefully comparing measurements and then entering his/her initials on the log.

Some GPS antennas have detachable ground planes and radomes. In order to help identify what exactly was used at a particular site, it would be useful to have a snapshot of the setup. All co-observers should take a photograph of the setup, if possible, with a close-up of the antenna as viewed from the side.

In addition, a rubbing of the stamping of the mark must be made at each visit to a station. If it is impossible to make a rubbing of the mark, a plan sketch of the mark must be substituted, accurately recording all markings.

Also, for each station visited, a visibility obstruction diagram must be prepared and the TO-REACH description carefully checked for errors or omissions.

Lastly, the following must be recorded at each occupation of a station:

- (1) receiver manufacturer,
- (2) antenna manufacturer,
- (3) receiver model number (part number),
- (4) antenna model number (part number),
- (5) the complete serial number of the receiver, and
- (6) the complete serial number of the antenna.

Success of this project requires that the highest quality GPS data be collected. Therefore, during each station occupation, the operators shall carefully monitor the operation of the receivers. Any irregularities in the data due to equipment malfunction, DOD adjustment of the satellite orbit, obstructions, etc., must be reported to the Field Operations Branch, N/NGS41, as soon as possible and noted on the observing log. If the quality of observations for an observing session is questionable, notify the Field Operations Branch immediately.



The survey team shall not depart the project area until they have quality reviewed all data, advised N/NGS21, and notified N/NGS41.

GPS DATA:

Visibility tables and plots of the present satellite constellation for July 26, 2000, have been reviewed and two observing windows selected. For operational use, current data must be generated with Trimble mission planning software or from program SATMAP.

A project report and data listed in Annex L of "Input Formats and Specifications of the NGS Data Base" and in the attached addendum for the adjustment portion of the project must be transmitted. Any data considered suspect as to quality in achieving accuracy standards should be sent via FedEx immediately for office review. Backup of transmitted data must be held until notified by the Field Operations Branch, N/NGS41.

The data set collected during the project shall be named "vtro070d.778". All records in connection with this project shall be titled "VERMONT AND NEW HAMPSHIRE FBN, 2000". The project number (accession number) is GPS-1506.

LIAISON:

Liaison must be maintained with designated offices at the National Geodetic Survey headquarters located at:

1315 East-West Highway  
Silver Spring, Maryland 20910-3282

Questions and problems concerning survey field operations should be directed to:

William T. McLemore, Jr.  
Chief, Field Operations Branch  
Observation and Analysis Division  
N/NGS41, SSMC III, Station 8564  
Telephone: 301-713-3215, ext. 117  
Fax: 301-713-4327  
e-Mail: Bill.Mclemore@noaa.gov

Questions and problems concerning adjustment processing should be directed to:

Maralyn L. Vorhauer  
Observation and Analysis Division  
N/NGS4, SSMC III, Station 8562  
Telephone: 301-713-3176, ext. 104  
Fax: 301-713-4327  
e-Mail: Maralyn.Vorhauer@noaa.gov

Questions and problems concerning vector processing should be directed to:

Juliana Blackwell  
Field Operations Branch  
Observation and Analysis Division  
N/NGS41, SSMC III, Station 8458  
Telephone: 301-713-3215, ext. 108  
Fax: 301-713-4327  
e-Mail: Juliana.Blackwell@noaa.gov

Questions and problems concerning using CORS data in processing should be directed to:

Neil Weston  
Geosciences Research Division  
N/NGS6, SSMC III, Station 9830  
Telephone: 301-713-2847, ext. 202  
Fax: 301-713-4475  
e-Mail: Neil.D.Weston@noaa.gov

Questions and problems which could affect the technical adequacy of the project should be directed to:

Stephen J. Frakes (Douglas R. Hendrickson)  
Chief, Project Development Branch  
Spatial Reference System Division  
N/NGS21, SSMC III, Station 8853  
Telephone: 301-713-3194, ext. 111 (ext. 127)  
Fax: 301-713-4316  
e-Mail: Steve.Frakes@noaa.gov  
(Doug.Hendrickson@noaa.gov)

The contact for the Vermont Capital CORS site (allow 3 or 4 days notice) is:

Mr. Dan Martin  
Vermont Agency of Transportation  
National Life Building, Drawer 33  
Montpelier, Vermont 05633  
Telephone: 802-828-2813  
Fax: 802-828-2334  
e-Mail: dan.martin@state.vt.us

To obtain data from the Quebec, Canada, base station Atrium, contact:

Mr. Yves Theriault, M.Sc.  
Service de la geodesie  
Ministere des Ressources naturelles  
5700, 4e Avenue Ouest, bureau E-305  
Charlesbourg (Quebec) Canada G1H 6R1  
Telephone: 418-627-6281, ext. 2009  
Fax: 418-646-9424

(The web site address is: <http://www.mrn.gouv.qc.ca>)

To obtain data from the Concord, New Hampshire, community base station and a CBN participant, contact:

Mr. Kerrie Hartshorn  
New Hampshire Department of Transportation  
1 Hazen Drive  
Concord, New Hampshire 03301  
Telephone: 603-271-1600  
Fax: 603-271-3914  
e-Mail: KHartshorn@dot.state.nh.us

The coordinator for the CBN in Vermont is:

Mr. Dan Martin  
(see the Vermont Capital CORS site contact above for  
address and telephone number)

Another contact for the CBN in Vermont is the NGS State Advisor:

Mr. Jim P. Richardson  
Vermont Agency of Transportation  
National Life Building  
Technical Services, Drawer 33  
Montpelier, Vermont 05633  
Telephone: 802-828-2813  
Fax: 802-828-2024  
e-Mail: james.richardson@state.vt.us  
Jprinv@hotmai.com

The coordinator for the CBN in New Hampshire is the NGS State Advisor:

Mr. Curt Crow  
New Hampshire Department of Transportation  
Survey Section  
P.O. Box 483  
J.O. Morton Building  
Concord, New Hampshire 03302-0483  
Telephone: 603-271-1600  
Fax: 603-271-3914  
e-Mail: clcrow@aol.com

Federal Express Address:  
4 Arnold Drive  
Bow, New Hampshire 03304

Other contacts for the CBN in New Hampshire are:

Mr. Greg Brown  
CLD Consulting Engineers  
540 Commercial Street  
Manchester, New Hampshire 03101  
Telephone: 603-668-8223  
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Mr. Cory Colwell  
Millette, Sprague, and Colwell, Inc.  
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Portsmouth, New Hampshire 03801  
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Mr. Ralf Platte  
Spectra Precision  
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Salisbury, New Hampshire 03268  
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Mr. Brian Haynes  
SFC Engineering Partnership, Inc.  
25 Sundial Avenue  
Manchester, New Hampshire 03103-7230  
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Mr. Andy Johnson  
Hayner/Swanson  
3 Congress Street  
Nashua, New Hampshire 03062  
Telephone: 603-883-2057  
e-Mail: ajohnson@hayner-swanson.com

Mr. Richie Ladd  
RSL Inc.  
32 Harriman Hill Road  
Raymond, New Hampshire 03077  
Telephone: 603-895-3986  
e-Mail: rsl@nh.ultranet.com

Mr. Bob Moynihan  
University of New Hampshire  
UNH-TSAS/Putnam Hall  
Durham, New Hampshire 03824  
Telephone: 603-862-1059  
e-Mail: rgml@christa.unh.edu

Mr. Mark Sargent  
RDB and Associates, Inc.  
7 Theatre Street, Suite 1  
Concord, New Hampshire 03301  
Telephone: 603-225-6770  
e-Mail: rdb@tiac.net

Mr. Dave Carlisle  
Berlin Technical Institute  
New Hampshire Technical College  
Berlin, New Hampshire 03570  
Telephone: 603-752-1113  
e-Mail: dcarlisle@tec.nh.us

Mr. Ken Clinton & Mr. Jack Kelly  
Meridian Land Services, Inc.  
31 Old Nashua Road  
Amherst, New Hampshire 03031  
Telephone: 603-673-1441  
e-Mail: MeridianLS@aol.com

Mr. Tim Bernier & Mr. Jonathon Crowdes  
T.F. Bernier, Inc.  
39 Warren Street  
Concord, New Hampshire 03301  
Telephone: 603-224-4148  
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Mr. Ralph Jackson  
HEB Associates  
2605 White Mountain Highway  
North Conway, New Hampshire 03860  
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e-Mail: rjackson@hebcivil.com

Mr. Eric Mitchell & Mr. Chris Hickey  
Eric Mitchell & Associates, Inc.  
55 South River Road  
Bedford, New Hampshire 03110  
Telephone: 603-627-1181  
e-Mail: Cmitch6704@aol.com

Mr. Paul Darbyshire  
Darbyshire Associates  
Sawtooth Road  
Gilmanton, New Hampshire 03237  
Telephone: 603-267-6640  
e-Mail: darbyshire@cyberportal.net

The contact for the Quebec, Canada, CBN co-observing is:

Mr. Bernard Perron  
Service de la geodesie  
Ministere des Ressources naturelles  
5700, 4e Avenue Ouest, bureau E-305  
Charlesbourg (Quebec) Canada G1H 6R1  
Telephone: 418-627-6281, ext. 2010  
Fax: 418-646-9424

(See the above contact, Mr. Yves Theriault, for the web site address.)

Names and telephone numbers of local contacts are given in the station description material.

ADDRESS:

Keep N/NGS41 informed of the party's post office, physical address, and telephone number at all times.

PUBLICITY:

See "NGS Operations Handbook," Section 1.4.1.

EXPENSES:

FBN expenses for this project will be charged to task number 8K6D2000. Expenses for the CORS FBN/CBN tie will be charged to task number 8K6D4000.

TRAVEL:

Travel and per diem are authorized in accordance with Federal Travel Regulations, Part 301-11, Per Diem Allowances. Current per diem rates were effective January 1, 2000.

ACKNOWLEDGMENT:

Please acknowledge receipt of these instructions in your Monthly Report.

cc: N/NGS - D. Zilkoski\*  
 N/NGS - S. Misenheimer\*  
 N/NGS1 - G. Mitchell  
 N/NGS1x1 - C. Crow  
 N/NGS1x1 - J. Richardson  
 N/NGS11 - S. Cofer  
 N/NGS21 - S. Frakes  
 N/NGS21 - R. Anderson  
 N/NGS21 - D. Hendrickson\*  
 N/NGS22 - T. Soler  
 N/NGS3 - E. Allen  
 N/NGS4 - E. Wade  
 N/NGS4 - M. Vorhauer  
 N/NGS4 - D. Hoar  
 N/NGS41 - W. McLemore  
 N/NGS41 - J. Blackwell  
 N/NGS412 - G. Means  
 N/NGS5 - R. Snay  
 N/NGS6 - N. Weston  
 FGCS Members\*  
 Dan Martin, Vermont Agency of Transportation  
 Paul Hodge, Vermont Agency of Transportation  
 Kerrie Hartshorn, New Hampshire Department of  
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 Greg Brown, CLD Consulting Engineers  
 Cory Colwell, Millette, Sprague, and Colwell, Inc.  
 Bob Champoux, University of New Hampshire  
 Ralf Platte, Spectra Precision  
 Brian Haynes, SFC Engineering Partnership, Inc.  
 Andy Johnson, Hayner/Swanson  
 Richie Ladd, RSL Inc.  
 Bob Moynihan, University of New Hampshire  
 Mark Sargent, RDB and Associates, Inc.  
 Dave Carlisle, New Hampshire Technical College  
 Ken Clinton, Meridian Land Services, Inc.



Jack Kelly, Meridian Land Services, Inc.  
Tim Bernier, T.F. Bernier, Inc.  
Jonathon Crowdes, T.F. Bernier, Inc.  
Ralph Jackson, HEB Associates  
Eric Mitchell, Eric Mitchell & Associates, Inc.  
Chris Hickey, Eric Mitchell & Associates, Inc.  
Paul Darbyshire, Darbyshire Associates  
Bernard Perron, Ministere des Ressources naturelles  
Yves Theriault, Ministere des Ressources naturelles  
Hubert Rousseau, Ministere des Ressources naturelles

\* first page only

**DATA TO BE SENT TO HEADQUARTERS RELATING TO  
THE ADJUSTMENT PORTION OF  
FBN/CBN PROJECTS**

Free adjustment in NAD 83 (UNIX run).

Plots of the free adjustment created by running "plotres\_prompt.bsh" on a UNIX server. Plots require a printer that supports postscript. The output file (long.out) contains a list of residuals which may be sorted using the following commands:

```
vi long.out
:1,$ !sort +0.47 (sorts horizontal residuals)
:1,$ !sort +0.71 (sorts vertical residuals)
```

(OPTIONAL) Constrained horizontal adjustment holding NGS CORS positions and ellipsoid heights.

Final combined Blue Book file (ASCII required) with \*86\* records (GEOID99).

Final description file (ASCII required.)

Final G-file (ASCII required.)

OBSCHK output.\*

CHKDDESC output.\*

OBSDES output.\*

\*Any errors or warning messages must be explained.